SIEMENS

PATENT
Attorney Docket No. 2003P11654WOUS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Inventor:	Matschullat	)	Group Art Unit: 1725
		)	
Serial No.:	10/569,781	)	Examiner: Kuang Y. Lin
		)	
Filed:	February 24, 2006	)	Confirmation No. 6080

Title: METHOD FOR PRODUCING AND CONTROLLING THE CASTABILITY OF LIQUID STEEL

Mail Stop Appeal Brief - Patent
COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

APPELLANT'S BRIEF UNDER 37 CFR 41.37

This brief is in furtherance of the Notice of Appeal filed in this application on September 10, 2007. A Fee Transmittal form PTO/SB/17 is transmitted concurrently with this paper to authorize the payment of the fee required for submittal of this brief.

1. REAL PARTY IN INTEREST - 37 CFR 41.37(c)(1)(i)

The real party in interest in this Appeal is the assignee of record of the present application, Siemens Aktiengesellschaft.

2. RELATED APPEALS AND INTERFERENCES - 37 CFR 41.37(c)(1)(ii)

There is no other appeal, interference or judicial proceeding that is related to or that will directly affect, or that will be directly affected by, or that will have a bearing on the Board's decision in this Appeal.

3. STATUS OF CLAIMS - 37 CFR 41.37(c)(1)(iii)

Claims pending: 39-44

Claims cancelled: 1-38

Claims withdrawn but not cancelled: None

Claims allowed: None

Claims objected to: None

Claims rejected: 39-44

The claims on appeal are 39-44.

4. STATUS OF AMENDMENTS - 37 CFR 41.37(c)(1)(iv)

A response was filed on August 10, 2007 under 37 CFR 1.116 subsequent to the final rejection. That response contained a request for reconsideration of the final rejection of all claims. No claim amendments were filed in the August 10, 2007 response. An Advisory Action was issued by the Office on August 17, 2007 sustaining the final rejection of all claims.

5. SUMMARY OF THE CLAIMED SUBJECT MATTER- 37 CFR 41.37(c)(1)(v)

The claimed invention relates generally to a method for predicting and controlling the castability of liquid steel. *See* paragraph [0007], p. 2, lines 27-29 of the substitute specification of the above-captioned application ("the substitute specification"). In the manufacture of steel, liquid steel is typically treated with adding alloying agents or other additives to provide a steel product with particular physical properties, i.e. toughness, hardness, corrosion resistance, etc. *See* paragraph [0003], p. 1, line 19 to paragraph [0004], p. 2, line 10 of the substitute specification. According to the specification, the present invention "...is based on the surprising discovery that interactions between the alloying elements and/or additive elements exist are not only relevant to these mechanical properties of the steel product, but also to the castability of the

melt." *See* paragraph [0009], p. 3, lines 1-3 of the substitute specification. Generally, "castability" of an alloy refers to those properties of the alloy that characterize its behaviour in the casting process. Casting may be generally defined as the pouring of molten metal into a mold to produce an object of desired shape.

Independent claim 39 is thus directed to a method for controlling the castability of liquid steel. The method includes establishing a first range of relative concentration limits for at least two elements of a melt such that a subsequent casting of the melt will exhibit acceptable mechanical properties. *See* paragraph [0004], p.2, lines 2-10; paragraph [0009], p. 3, lines 4-6; and paragraph [0010], lines 14-17 of the substitute specification. Once the first range of relative concentration limits have been established, the method further comprises establishing a second range of relative concentration limits for the at least two elements of the melt as a subset of the first range of relative concentration limits such that the melt is castable. *See* paragraph [0011], p.3, line 28 to p. 4, line 7 of the substitute specification. Thereafter, once the second range has been established, the method further comprises controlling chemistry of the melt to within the second range of relative concentration limits. *See* paragraph [0045], p. 10, lines 10-12 of the substitute specification. In this way, a melt is provided that exhibits both desirable mechanical properties and castability.

Dependent claim 40 requires that the method of claim 39 further comprises establishing the second range of relative concentration limits between elements of the group consisting of C, Si, Mn, S, Al, N, Zn and O2. As stated at paragraph [0017], p. 5, lines 20-22 of the substitute specification, "[i]t has been found the restriction to these eight alloying elements and/or additives is sufficient to achieve a considerable improvement in castability."

Dependent claim 41 requires that the method of claim 39 further comprises establishing the second range of relative concentration limits between at least one of the group consisting of N/O2, Zn/O2, S/Zn, C/Zn, Mn/S, Mn/N, Si/C, Al/C, Si/O2, S/O2, Al/O2, S/C, and N/C. As indicated in paragraph [0018], p. 5, line 28 of the substitute specification, these 13 pairs of alloying elements have been recognized as influencing castability.

Dependent claim 42 requires establishing the second range of relative concentration limits between at least one of the group consisting of Si/O2, S/O2, Si/ O2, Al/O2, S/C, and N/C. As indicated in paragraph [0018], p. 5, lines 29-31 of the substitute specification, these "five pairs have a serious effect on castability..." and "[e]ven if only these five pairs were taken into account with a view to achieving an efficient method it is still possible to achieve excellent results [in] predicting and controlling the castability." *See also* paragraph [0045], p. 10, line 9 of the substitute specification (the five pairs "must be investigated at a minimum.")

Dependent claim 43 requires that the method of claim 39 further comprises: displaying the first range on a graph illustrating concentrations of a first element along a first axis and concentrations of a second element along a second axis; displaying the second range on the graph area as a sub-area of the first range; and displaying a measured relative concentration of the first and second elements in the melt as a point on the graph. *See* paragraph [0010], p. 3, lines 10-26; and from paragraph [0041], p. 9, line 17 to paragraph [0049], p., 11, line 14 of the substitute specification. These elements provide a quick method for determining whether the subject elements lie within the castable (second) range.

Dependent claim 44 requires that the method of claim 39 is used in a thin-strip continuous casting machine according to a twin-roller casting process. *See* paragraph [0022], p. 6, lines 19-21: "[t]he method according to the invention can be used particularly advantageously in a thin-strip continuous casting machine operating on the principle of the twin-roller casting process."

6. GROUNDS OF REJECTION TO BE REVIEWED UPON APPEAL - 37 CFR 41.37(c)(1)(vi)

The grounds of rejection to be reviewed is whether claims 39-44 stand rejected under 35 USC 112, first paragraph as failing to comply with the enablement requirement of 35 USC 112, first paragraph.

7. ARGUMENT 37 CFR 41.37(c)(1)(vii)

Arguments applicable to claims 39-44

Applicants are appealing the rejections of claim 39-44 in the above-referenced application because: (a) the Examiner has failed to establish a reasonable basis to question the enablement provided for the claimed invention; and (b) claims 39-44 are enabled by the specification for performing the method of the claimed invention.

a. The Examiner has failed to establish a reasonable basis to question the enablement provided for the claimed invention by failing to use the proper test to determine the enablement of the claims

First, the rejections of claims 39-44 under 35 USC 112, first paragraph must be removed because the Examiner failed to follow USPTO guidelines for establishing a reasonable basis to question the enablement provided for the claimed invention by failing to use the proper test to determine the enablement of the claims. To determine whether the claims are enabled by the specification, the test is whether one skilled in the art could make and use the claimed invention from the disclosure coupled with information known in the art without undue experimentation. *United Stated v. Telectronics, Inc.*, 857 F.2d 778, 8 USPQ2d 1217 (Fed. Cir. 1988); In re Stephens, 188 USPQ 659 (CCPA 1976). Critically, the test of enablement is not whether any experimentation is necessary, but whether, if experimentation is necessary, it is undue. *In re Angstadt*, 190 USPQ 214 (CCPA 1976) (Emphasis added). Thus, even if an Applicant appears to have not disclosed how to perform a particular element, this omission is not fatal to the application unless the Examiner establishes a reasonable basis why it would have taken undue experimentation to carry out the claimed invention. In the present application, the Examiner only maintained that the specification did not make clear how to perform certain elements of the invention.

For example, in the Final Office Action dated June 11, 2007, the Examiner stated that his reasons for the rejection of the claims under 35 USC 112 as failing to comply with the enablement requirement were the same as the objection of the specification in the same paper. Those reasons were:

> The specification is objected to under 35 USC 112, 1st paragraph in that in page 3, [0009], it states that the invention is based on the surprising discovery that interactions between the alloying elements and/or additive elements exist that are not only relevant to the mechanical properties but also to the castability of the melt. These are new and different interactions that are independent of the known interactions taken into account up to now. The interactions of the alloying elements and/or additive elements influencing the castability are taken into account in the alloy calculations as supplementary conditions. Further, in pages 7-8, [0032] and page 8, [0034], it states that the mathematical models used in alloy equation 1 take into account these interactions. However it is not clear what kind of mathematical models and equation 1 are referred to. Also, it is not clear how those new and different interactions are obtained and how those interactions are used in the mathematical models and equation 1.

In the Advisory Action dated August 10, 2007, the Examiner stated:

> Continuation of 11. does not place the application in condition for allowance because: (1) applicant stated that the mathematical models are adequately described by illustrating the simple x-y single pair example of Fig. 2-4. However, it is not clear how the mathematical models are deduced from figures. (2) In claim 39, it recites to establish a second range as a subset of the first range. however, it is not clear how the subset is obtained, i.e. what kind of mathematical model or equation is used such that to obtain the subset. (3) in figures 3 and 4, how the lines 10-11-12, 14-15, 15-16 are obtained? (4) it appears the applicant described the designated result to be obtained without specifically describing as how or with what process steps are performed such that the designated result was obtained?

As can be seen, the Examiner never once addressed during the prosecution of this application whether it would require undue experimentation to carry out the claimed invention. This was wholly improper because the standard in evaluating whether the claims are enabled by the specification is not whether any experimentation is necessary, but whether, if experimentation is necessary, it is undue. *In re Angstadt*, 190 USPQ 214 (CCPA 1976). For this reason alone, Applicants request that the 35 U.S.C. 112 rejections be removed because the Examiner failed to establish a reasonable basis for questioning the enablement provided for the claimed invention and use the proper test to determine the enablement of the claims.

b. Claims 39-44 are expressly enabled by the specification for performing the method

Moreover, as set forth below, the specification as originally filed discloses at least one method for making and using the claimed invention that bears a reasonable correlation to the entire scope of the claims. As long as the specification discloses at least one method for making and using the claimed invention that bears a reasonable correlation to the entire scope of the claim, then the enablement requirement of 35 U.S.C. 112 is satisfied. In re Fisher, 427 F.2d 833, 839, 166 USPQ 18, 24 (CCPA 1970).expressly supports and enables the claimed invention. The elements of claim 39 are taken one by one as set forth below. Claim 39 in its entirety recites:

A method for controlling the castability of liquid steel, the method comprising:

establishing a first range of relative concentration limits for at least two elements of a melt such that a subsequent casting of the melt will exhibit acceptable mechanical properties;

establishing a second range of relative concentration limits for the at least two elements of the melt as a subset of the first range of relative concentration limits such that the melt is castable; and

controlling chemistry of the melt to within the second range of relative concentration limits.

i. establishing a first range of relative concentration limits for at least two elements of a melt such that a subsequent casting of the melt will exhibit acceptable mechanical properties

In order to establish a second range of relative concentration limits for the at least two elements of the melt…such that the melt is castable, a first range of relative concentration limits for at least two elements of a melt is established such that a subsequent casting of the melt will exhibit acceptable mechanical properties. This step of establishing a first range of relative concentration limits represents the state of the art at the time of the claimed invention as set forth in paragraph [0004], p. 1, line 32 to p. 2, line 10 of the substitute specification:

> In order to manufacture from the melt a specific steel quality having defined material properties such as strength, toughness, hardness, corrosion resistance etc., it is necessary to add metal and non-metal alloying elements and additives.

> Mathematical models are used for this purpose, said models calculating from a latest analysis of the melt the material composition of the required alloying elements and additives in order to obtain a very specific steel quality. The proportions of the metal and non-metal elements are thereby set in a defined band. Additional strength formulae that take account of the interactions between the alloying elements and additives in the melt are applied in a quality center in order to assess the expected material properties. These formulae are mainly empirical. In conventional works comprising steelworks, ladle furnace and continuous casting machine, such calculations of the interactions of the additives and alloying elements are at best performed offline in quality centers. The strength formulae and empirical formulae cited in the literature are simplified models for the complex interactions of the alloying elements and additions that influence the material properties of the cast steel.

Thus, according to the present application, strength formulae and empirical formulae cited in the literature provide models for the complex interactions of the alloying elements and additives. The formulae are used account for the complex interactions of the alloying elements and additions that influence the mechanical properties of the cast steel and provide a first range of relative concentration limits for at least two elements of a melt such that a subsequent casting of the melt will exhibit such acceptable mechanical properties. These formulae were known in the art at the time of the claimed invention. In view of the above, this element is clearly enabled by the specification. It is noted that the Examiner did not express any issue with the enablement of this particular element.

ii. <u>establishing a second range of relative concentration limits for the at least two elements of the melt as a subset of the first range of relative concentration limits such that the melt is castable</u>

After establishing a first range of relative concentration limits for at least two elements of a melt such that a subsequent casting of the melt will exhibit acceptable mechanical properties, a second range of relative concentration limits for the at least two elements of the melt is established as a subset of the first range of relative concentration limits such that the melt is castable. This represents an important element of the claimed invention as "[t]he invention is based on the surprising discovery that interactions between the alloying elements and/or additive elements exist that are not only relevant to the mechanical properties, but also to the castability of the melt." *See* paragraph [0009], p. 3, lines 1-3 of the substitute specification.

The specification is clear as to the basis for which the second range is established and provides a method for establishing the second range as claimed. First, the specification makes clear that the first range may be narrowed based upon the empirical data gathered from the melts already cast as is described repeatedly in the application. *See* paragraph [0011], p. 3, lines 28-31 of the substitute specification, which states "...it is provided in the method according to the present invention that based on the alloying elements and/or additives related to each other, at least one permitted range, with which a castable melt is expected, is defined for the proportions of alloying elements and/or additives." Thereafter, the substitute specification provides at paragraph [0011], p. 4, lines 2-4 that "...the range that specifies the permitted proportions of the individual alloying elements and additives must be adjusted to take into account the data gathered on melts already cast, i.e. must be reduced in size." Thus, the specification describes that the first range is narrowed to establish a second range of relative concentration limits for the at least two elements of the melt as a subset of the first range of relative concentration limits such that the melt is castable based upon "data gathered on melts already cast."

To then establish the specific values of the second range, the specific values can be determined by simply reviewing the above-mentioned historical data and designating each of the melts castable or uncastable. In this way, the second range can be established by determining minimum and maximum values for each element that provided castable melts historically. For example, paragraph [0010], p. 3, lines 24-26 of the substitute specification states "[i]n order to be able to take into account the data gathered on the melts, it is provided in the method according to the invention that the information "castable" or "uncastable" is assigned to each cast melt." Further, paragraph [0010], p. 4, lines 2-7 of the substitute specification states "....the range that specifies the permitted proportions of the individual alloying elements and additives must be adjusted to take into account the data gathered on melts already cast, i.e. must be reduced in size. If the gathered data is taken account, with each melt being assigned the information 'castable or uncastable,' then it is possible to define specific ranges as permitted in which those melts lie that have proved castable in the past." Thus, to establish the second range, one skilled in the art may provide historical data for a melt, assign the melt as being castable or uncastable, and establish a range, as a subset of the first range, that have proved castable in the past. Since the specification

expressly provides at least one method for making and using the claimed invention that bears a reasonable correlation to the entire scope of the claims, the specification is fully enabling for the claimed limitation.

Applicants note that it appears the Examiner may have been confused by reference in the specification to the use of mathematical models and the use of neural networks. It is duly noted that the use of mathematical models is not required by the claims of the present invention and the discussion of neural networks appears to be related to the objection to the specification of the present application under 35 U.S.C. 112, first paragraph (not addressed by this paper per 37 C.F.R. 41.31). A thorough inspection of the specification reveals that the use of mathematical models in the invention may optionally be used to establish the first range, for example, by using mathematical models to account "for the complex interactions of the alloying elements and additions that influence the material properties of the cast steel." *See* paragraph [0004], p. 2, lines 9-10 of the substitute specification. As described above, the use of mathematical models in this regard refers to well-established methods in the art for determining the interactions of the alloying elements and additives that influence the material properties of the cast steel. The specification then further states that, in particular embodiments, neural networks can be used to carry out such mathematical models so that "the invention can be implemented particularly quickly and in part automatically." *See* paragraph [0014], p. 4, lines 23-25 of the substitute specification.

Neural networks are a commonplace data analysis tool for reviewing large quantities of data. For an explanation of a neural network, *See e.g.* U.S. Published Patent Application No. 20070016389, paragraph [0080], p. 4, lines 10-13 stating that "[n]eural networks are a well-recognized mathematical technique that analyze large quantities of data and develop relationships between the independent variables in the data and the dependent variables in the data." A recent search (conducted November 5, 2007) of the USPTO database showed 6,459 issued U.S. patents use the term "neural networks" in the specification. As such, neural networks are a well-known tool for automatically determining the relationships in data that can be applied to any kind of data regardless of its source or type. One skilled in the art would thus readily be able to use a neural network should a person so desire in the claimed invention.

However, as discussed above, the use of neural networks for carrying out the mathematical models in the present invention is not required by the claims. The specification completely enables a method of determining the first range and second range as claimed, and for controlling the chemistry of the melt as claimed without the use of a neural network, if so desired.

iii. controlling chemistry of the melt to within the second range of relative concentrations

After establishing the first and second ranges of relative concentration limits for the at least two elements of the melt as a subset of the first range of relative concentration limits such that the melt exhibits desired mechanical properties and is castable, the method of claim 39 requires controlling chemistry of the melt to within the second range of relative concentrations. Instructions for controlling chemistry of the melt to within the second range of relative concentration limits are found in a plurality of locations in the specification. For example, at paragraph [0034], p. 8, lines 10-14, the substitute specification states: "[i]f it was calculated that the melt is castable, the method continues with the determination of operating diagrams 2 for the electric-arc furnace and the ladle furnace. If the result of the alloy equation 1 is "uncastable," more alloying elements or additives, for example, must be added, or treatment steps, such as the addition of inert gas or oxygen are required." Thus, the specification provides that if the melt is determined to be castable, the casting process may proceed and if not so determined, additional components or treatments steps must be administered. Applicants note, although not required by this element of the claim, the process for determining whether the components of the melt are within the established second range are provided in Figs. 2-4 and from paragraph [0040], p. 9, line 14 to paragraph [0049], p. 11, line 14 of the substitute specification.

For example, the specification teaches a method for determining whether the components of the melt fall within the second range of relative concentration limits through graphical representation of the ranges, for example, at Fig. 2 and paragraph [0042], p. 9, lines 23-27 of the substitute specification. Fig. 2, for example, illustrates the prior art range of acceptable concentrations for elements x and y as the two sets of straight lines parallel to the respective x or y axis. *See* paragraph [0041], p. 9, lines 17-19 of the substitute specification. It was well known

that prior art alloy calculations simply adjusted the elemental composition of the melt so that it would fall within the rectangle defined by these parallel lines as shown in Fig. 2. Paragraph [0042], p. 9, lines 23-27 of the substitute specification explains that the alloy calculations under the claimed invention must also ensure that the material properties lie within a castable range existing within region 6 of Fig. 2. Thus, a melt at point 7 of Fig. 2 would be acceptable in the prior art because it would predict acceptable mechanical properties, however, under the presently claimed method it would be rejected because it is outside of region 6. Similarly, in Fig. 3, a first analysis of a melt reveals that it is at an uncastable point 10, then a treatment of the melt is carried out in an attempt to move the relative concentrations of C and S to within triangle 9, and an acceptable melt chemistry is finally achieved at point 12. *See* paragraph [0046], p. 10, lines 21-32 of the substitute specification.

In view of the above remarks, methods for performing the limitation "controlling chemistry of the melt to within the second range of relative concentrations" are clearly taught by the specification.

c. Dependent Claims

Regarding the dependent claims, Applicants note:

The requirements of dependent claim 40 are expressly recited at, for example, paragraph [0017], p. 5, lines 18-22 of the substitute specification

The requirements of dependent claims 41-42 are expressly recited at, for example, paragraph [0018], p. 5, lines 23-31 of the substitute specification.

The requirements of dependent claim 43 are repeatedly illustrated, for example, from paragraph [0040], p. 9, line 14 to paragraph [0049], p. 11, line 14 of the substitute specification.

The requirements of dependent claim 44 are expressly recited, for example, at paragraph [0022], p. 6, lines 19-21 of the substitute specification.

d. Conclusion

In view of the above, the specification expressly provides at least one method for making and using the claimed invention that bears a reasonable correlation to the entire scope of claims 39-44. Accordingly, the rejections of claims 39-44 as not being enabled by the specification

must be removed. If for some reasoning, the Board believes the specification does not expressly disclose a method for carrying out the invention, the rejections must still be removed because the Examiner failed to establish a reasonable basis to question the enablement provided for the claimed invention by failing to use the proper test to determine the enablement of the claims – whether one skilled in the art could make and use the claimed invention from the disclosure coupled with information known in the art without undue experimentation.

8. CLAIMS APPENDIX - 37 CFR 41.37(c) (1) (viii).

A copy of the claims involved in this appeal is attached as a claims appendix under 37 CFR 41.37(c) (1) (viii).

9. EVIDENCE APPENDIX - 37 CFR 41.37(c) (1) (ix)

None is required under 37 CFR 41.37(c) (1) (ix).

10. RELATED PROCEEDINGS APPENDIX - 37 CFR 41.37(c) (1) (x)

None is required under 37 CFR 41.37(c) (1) (x).

Respectfully submitted,

Dated: 11/8/07

By: _____

Erik C. Swanson
Registration No. 40,194
(407) 736-5602

Siemens Corporation
Intellectual Property Department
170 Wood Avenue South
Iselin, New Jersey 08830

APPENDIX OF CLAIMS ON APPEAL

39. A method for controlling the castability of liquid steel, the method comprising:

establishing a first range of relative concentration limits for at least two elements of a melt such that a subsequent casting of the melt will exhibit acceptable mechanical properties;

establishing a second range of relative concentration limits for the at least two elements of the melt as a subset of the first range of relative concentration limits such that the melt is castable; and

controlling chemistry of the melt to within the second range of relative concentration limits.

40. The method of claim 39, further comprising establishing the second range of relative concentration limits between elements of the group consisting of C, Si, Mn, S, Al, N, Zn and O2.

41. The method of claim 39, further comprising establishing the second range of relative concentration limits between at least one of the group consisting of N/O2, Zn/O2, S/Zn, C/Zn, Mn/S, Mn/N, Si/C, Al/C, Si/O2, S/O2, Al/O2, S/C, and N/C.

42. The method of claim 39, further comprising establishing the second range of relative concentration limits between at least one of the group consisting of Si/O2, S/O2, Si/ O2, Al/O2, S/C, and N/C.

43. The method of claim 39, further comprising:

displaying the first range on a graph illustrating concentrations of a first element along a first axis and concentrations of a second element along a second axis;

displaying the second range on the graph as a sub-area of the first range; and

displaying a measured relative concentration of the first and second elements in the melt as a point on the graph.

44. The method of claim 39 used in a thin-strip continuous casting machine according to a twin-roller casting process.

EVIDENCE APPENDIX

None.

RELATED PROCEEDINGS APPENDIX

None.